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APRIL, 1933

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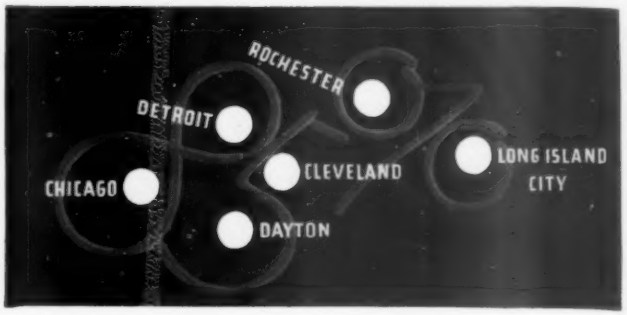

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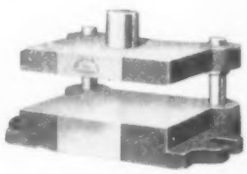

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A. S. T. E. Journal

Published by the American Society of Tool Engineers

8316 Woodward Avenue

Detroit, Michigan

William H. Smila, President

Frank Hartlep, First Vice-President

T. B. Carpenter, Second Vice-President

A. M. Sargent, Secretary

Joseph F. Slavik, Treasurer

Published for Members Only

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Owing to the nature of the American Society of Tool Engineers organization, it cannot be responsible for statements appearing in the Journal either as advertisements or in papers presented at its meetings or the discussions of such papers printed herein.

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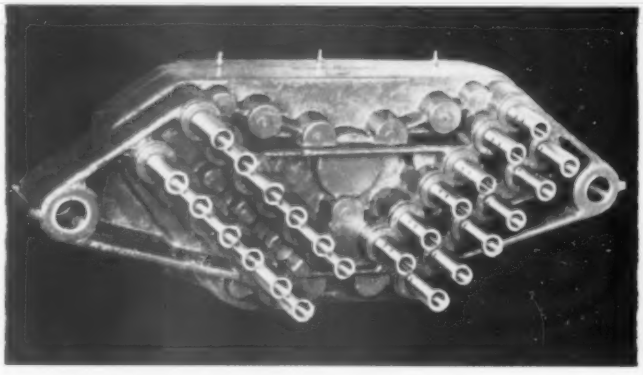

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NEW A. S. T. E. OFFICERS

On Thursday evening, March 16, at a regular meeting of the Board of Directors of the American Society of Tool Engineers, the names of the officers for the year 1933 were announced. Names and connections of the officers are as follows:

President—
William H. Smila, Tool Engineer,
Chrysler Corporation (Jefferson Plant),
Detroit, Michigan.

First Vice-President—
Frank Hartlep, Chief Tool Engineer,
Timken-Detroit Axle Company,
Detroit, Michigan.

Second Vice-President—
T. B. Carpenter, Assistant Tool Supervisor,
General Motors Truck Corporation,
Pontiac, Michigan.

Secretary—
A. M. Sargent—
President and General Manager,
Pioneer Engineering and Manufacturing Co.,
Detroit, Michigan.

Treasurer—
Joseph F. Slavik, Sales Engineer,
Warner and Swasey Company,
Detroit, Michigan.

Past President—
J. A. Siegel, Assistant Chief Tool Engineer,
Packard Motor Company,
Detroit, Michigan.

Mr. Siegel has been named Chairman of the Meetings Committee. Communications pertaining to speakers or pictures of engineering subjects to be presented at A. S. T. E. meetings should be addressed to the attention of Mr. Siegel.

SECRETARY'S ANNUAL REPORT

The first year of existence of the American Society of Tool Engineers is at an end. This Society, despite adverse business conditions, which have, without doubt, been most drastically severe to tool engineers, has much to be proud of in the fact of its stable growth, its class and calibre of membership, and last, but not least, the loyalty and support of all concerned.

This Society, while less than a year old, is represented in 15 states and 5 foreign countries, and lists amongst its membership major executives in production and tool engineering from practically all the major industries. The Society was created in order to advance, promulgate, and further the Arts and Sciences of Tool Engineering among the members of the Society; to bring about good fellowship fraternity and the spirit of brotherhood among the members; to hold readings and discussions on professional papers and reports at meetings called for that purpose; to publish and disseminate such papers and reports to the members.

The Secretary's Office and all its co-operating assistants have been greatly gratified to have been in a position to watch and be guided by a staff of officers and a board of directors such as have governed your Society's progress during these trying months.

Keen minds are joining your roster. Industrial publications are giving you notices in nearly every issue. Your Journal, every issue, is on file in the Library of Congress, also the Detroit Public Library. Several Universities and Colleges have requested information and copies of our publication. Statistically you have sponsored as a society approximately

5919 Journals mailed
4170 Letters and statements mailed
165 Checks issued
705 Checks and accounts received
680 Telephone calls made
467 Members investigated and entered
558 Prospects canvassed and catalogued.

The Society records of tool engineers and their affiliation and experience are undoubtedly the most complete and authentic to be found anywhere in this district. It is hoped that ultimately this will be as important as the Bar Association or the Physician's Registry.

May you all enter your second year as members, under your newly elected officers, with a real pride in your ability to support a work of so much value to both yourselves and to industry in general. I wish to thank personally all those with whom I have worked for their warm support and assistance, and trust that all the friendships either newly made or strengthened by this contact will endure perpetually.

A. M. Sargent
Secretary.

OUR NEW PRESIDENT

TO THE MEMBERS OF THE A. S. T. E.:

Our society has now reached its first milestone and during this first year exceptional progress has been made considering the existing business and financial conditions. We have more than doubled our membership during the past six months, and have added strength to our organization, not alone in number of members but in the knowledge and experience of these new members.

We are hopeful that during the coming year enough members from cities and towns outside of the Detroit area can be added to our rolls to warrant the chartering of new chapters. This can best be done by several members in any community forming themselves into a committee. This committee can then make a survey of all eligible prospective members in the community and create enough interest and enthusiasm in the society to induce these "prospects" to join. As soon as these prospective members have been enrolled this committee can petition the society for a charter. This charter will entitle the newly formed chapter to elect its own officers, hold its own meetings and function as per the by-laws governing chapters. These by-laws will be available within a few days and can be had by a request made to the Secretary of the Society.

WILLIAM H. SMILA

During the past year we have established a Standardization Committee from which we expect some real results. These results can only be obtained by each and every member of the Committee performing all tasks assigned to him. The "let George do it" attitude will never reach the desired goal. We are anxious to have any member (either in or out of the Detroit area), not at the present time serving on this committee, volunteer to serve, if his interests lie in that direction. Do not fail to notify any officer or director of the A. S. T. E. if you are willing to serve.

Each member should plan to attend the regular monthly meetings of the Society. By so doing he will broaden his acquaintance with the membership and also hear some interesting lectures and discussions. These meetings are held at 8 P. M. on the second Thursday of each month. The regular meeting place is the Detroit-Leland Hotel. Reserve these dates and become a regular attendant as our new Meetings Committee is planning some very interesting and instructive programs. Non-members are cordially invited to attend any of these meetings.

This society, like most corporations and individuals, has its funds "tied up" in one of the banks which up to the present time has released but ten per cent of the amount on deposit. Due to this fact it is very important that every member pay his dues at once, in cash. This cash is needed to carry on the activities of the society until such time as a much greater percentage of our funds are released.

W. H. SMILA,
President-elect.

OUR PRESIDENT
IN PERSPECTIVE

On Thanksgiving Day in the year 1891, a baby boy was born in the village of Weston in Wood County, Ohio; the state famous as the birthplace of Presidents. They called him "Bill," but his birth certificate reads "Wallace Harold Smila."

Not realizing that the race is subject to measles, work, and depressions, Bill just went ahead and grew up. In due time he graduated from high school and went to work in the shops of the Lake Shore Electric Railway Company at Fremont, Ohio. He soon discovered that this was what was known as "work." After working there a little more than a year, his boss told him the well-known fairy tale about the youngster who went to college, so he wouldn't have to work. So young Bill, being tired and not wise in the ways of the world, started a mechanical engineering course at Ohio Northern University.

All was going along in the usual manner until the year before he was to graduate. It seems that in those days young men's minds also turned lightly to thoughts of love in the spring, so things continued to go along in the usual manner and Bill was married in June, on commencement day, to a blithesome young coed and the remainder of Bill's education was gleaned from the University of Hard Knocks.

From college, Mr. and Mrs. Smila journeyed to Clyde, Ohio, where Bill worked in the tool room of the Elmore Automobile Company for nine months, after which he was transferred to the tool design department for three months.

His first child, a daughter, was born in Clyde, Ohio. She is now in her junior year at the college in which her dad was married in his junior year. Bill has hoped however that, due to the depression, she may pull through O K and not follow the precedent he set.

When the manager of the Elmore Manufacturing Company secured a position with the Cleveland-Galion Motor Truck Company, he persuaded Bill to move his family to Galion, Ohio, and work for him as a designer of tools for making motor trucks. When the chief tool designer of this company resigned, Bill was promoted to his position. He was with this company for a year.

The chief tool designer whose place Bill now occupied wrote him to come to Pittsburgh to do machine designing for the Westinghouse Machine Company. Eighteen months later he left Pittsburgh and went back to his home to design tools for the Krebs Commercial Car Company which was later known as the Clydesdale Truck Company. Three months after this he went to work for Bob Spur at Packard's in Detroit as a tool designer and later for Jack Crain who succeeded Spur as chief tool designer.

In those days, W. F. MacLaren was foreman of the cylinder block department at Packard's. Later McLaren was made superintendent of the Simplex Automobile Company at New Brunswick, N. J. Bill went along with him as a tool designer to help tool up the Hispano Suiza aircraft engine. Just prior to the time that the Simplex Company was merged with the Wright Aircraft Corporation, Bill was placed in charge of operation planning. After the amalgamation, he became assistant tool superintendent.

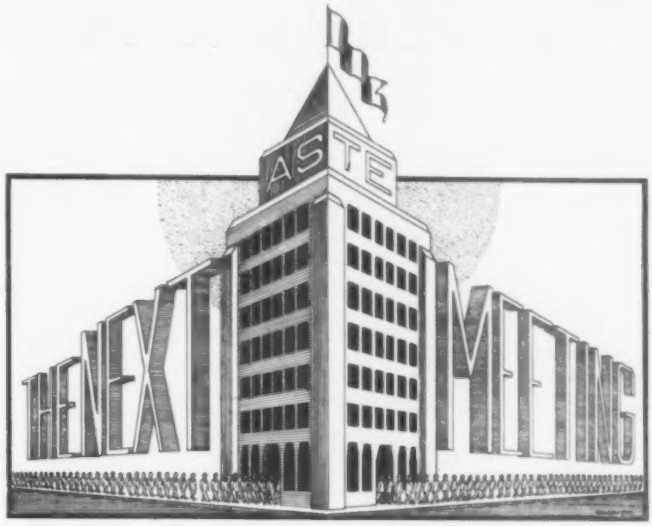
After being there three years, he was again carried away by someone whom he had met on the job. You recall that in college he was also "carried away" by someone he met on the job. This time the friend was S. H. Humphrey who had resigned his position as factory manager for the Wright Aircraft Corporation to start his own company, the H. L. & W. Sales and Mfg. Co., in Detroit, with Bill as chief tool designer.

Thirteen months later, Bill went to work as chief tool designer for Mr. E. R. Jacoby, whom he had met at the Wright Martin Corporation and who was made superintendent of the Machinery Manufacturing department of the United States Rubber Company in Detroit. Bill worked for him for six years, but when the U. S. Rubber Company was reorganized in 1927, the tool designing department was discontinued (as an unnecessary evil?), so he immediately went to work at the Jefferson Ave. plant of the Chrysler Corporation as a tool designer. Within six months he had held successively—and obviously successfully—the position of tool designer, checker, assistant tool engineer, and his present one, tool engineer, the duties of which he has faithfully fulfilled since 1927.

He says he is teaching his three-and-a-half year old son, William Wallace to be a yodeler.

Every member of the A. S. T. E. is back of Bill 100%.

Thursday,
April 13, 1933,
at
Detroit Leland Hotel,
8 P. M.



Speaker:
Mr. L. A. Danse.
Subject:
"Metallurgy as It Concerns the Tool Engineer."

Mr. Danse, of Cadillac Motor Car Company, requires no introduction to members of the A. S. T. E., as his excellent talk at the second meeting of the Society still, no doubt, lingers pleasantly in the memory of all of us.

Mr. Danse was born at Helena, Montana in 1889. He received his higher education at Purdue. His first four years of practical experience were spent as a machinist and tool maker. Then for three years he was a mining prospector and assayer, following this with two years at layout and installation in a pumping plant. His next two years were spent as foreman of an experimental laboratory. His last ten years have been occupied as foreman, heat treat superintendent, and on layout and plant control, leading to his present position of plant metallurgist for Cadillac Motor Car Company.

Mr. Danse will speak on the subject, "Metallurgy as It Concerns the Tool Engineer."

Contrary to previous tentative plans, there will be no dinner at the April meeting. The evening will be featured by the installation of the new officers of the Society.

OUR DEPARTING PRESIDENT'S MESSAGE

In reviewing our Society's activities over the past year, I experience a feeling of great satisfaction from the benefits I received from the organization, and I am wondering whether the members in general received the same satisfaction through their affiliation with the Society.

Perhaps a knowledge of the unique but simple origin of the American Society of Tool Engineers and a brief summary of some of its accomplishments would tend to increase the members' appreciation of the advantages of membership in this body. In January of 1932 I received an invitation from Mr. O. B. Jones, President of the Detroit College of Applied Science, to attend a meeting at that institution for the purpose of considering the organizing of a tool engineering society. The meeting was attended by twelve or fifteen tool engineers from the larger manufacturing plants of Detroit.

I had expected meeting Mr. Jones The Promoter or The Organizer with his plans all cut and dried, but we met just Mr. Jones the humble and unassuming, who greeted us with "Gentlemen, you were invited here to discuss the possibility of starting a tool engineering society." When asked what his plans were he said he had none, and, further, when asked that he serve as Chairman of the meeting he replied that he would prefer to have some one else serve, so there he sat on the side lines with the others and the discussion began.

Other meetings followed with new faces in attendance, and thus our Society came into being from the grouped ideas of men who, while possessing aggressiveness and leadership, seemed imbued with that virtue of unselfish timidity so well exemplified by Mr. Jones at that first meeting. It was upon this foundation of honest, sound, and progressive principles of co-operation that our Society was founded and to which we have strictly adhered in our attempts to reach that unattainable goal, perfection in the profession of tool engineering.

We have received the approval and co-operation of the manufacturer, and have enjoyed our relations with other major engineering societies, while not forgetting the courtesies shown us by national engineering publications and the helpful assistance rendered us by the advertisers in our own Journal.

We have received criticisms and have benefitted by them, not so much through change in policy as by the sound explanation and expounding of our principles. On a few occasions outsiders interpreted our Society as constituting a union, while others criticized us for not being a union. To these critics

(Concluded on Next Page)

EDITORIAL PAGE

I TAKE OFF MY HAT

Saturday March 4 brought a thrill to a lot of people when they heard Franklin D. Roosevelt's inauguration speech. They were not accustomed to hear a man in high public office speak so openly and plainly. The President called a spade a spade and not a horticultural implement.

The people have known that we were facing a serious national situation, despite the fact that they had been told that everything was all right and that conditions were improving. Nevertheless they continued to carry on doing their best, each in his own way.

One disappointment has followed another since 1929. Each one provoked a joke and a smile and the people carried on. Even with the banks all closed much humor was found in the situation. Imagine the wailing and gnashing of teeth which would follow similar action on the part of the banks in lots of countries. I take off my hat to the American people for the way they have taken their licking and express the thought that it is hard to whip a people who smile in the face of trouble and keep on going.

Our new President has brought much encouragement to us by his direct method of attack. We now have a leader who fights with both fists directly at the heart of the trouble, and the whole nation must support him in the fight for our common good.

OUR HOPE

Now that the bank is opening "just around the corner," those of us who have not yet paid our dues for 1933 will without a doubt respond to the urge to do our bit toward refueling the good old A. S. T. E. ship so that it may continue to plow triumphantly and irresistibly on through and out of the decreasing seas of adversity.

The first faint rays of the rising sun now illuminate the scene, bringing a new hope that we will soon be worrying about parking space at the factory and income taxes. We know that the day of rest is nearly over and that we must, and will, find jobs soon.

In the findings of jobs, your Society, through its meetings and its Journal, constitutes the most simple and sure means available. Those who are employed have doubtless paid their dues. The remaining few who have not as yet done so are doubtless those who are unemployed and who therefore will need to keep well informed as to when and where jobs will be available. The A. S. T. E. will do its best to serve you in this manner, as one of its duties to you and the industry. Weeks and months may thus be saved you in your search for employment. Members realizing this will, if necessary, sacrifice to some extent to pay their dues, and avail themselves of this obvious advantage.

If you want the Journal to continue to reach you each month, if you believe in the good your Society is doing, mail your dues at once or, at least, a letter of explanation to Mr. A. M. Sargent, Secretary, American Society of Tool Engineers, 8316 Woodward Avenue. Atta boy!

OUR DEPARTING PRESIDENT'S MESSAGE

(Concluded from Page 7)

and to all who read these lines, let me most emphatically state that we are not a union, nor do we ever aspire to become one, for such would be a direct violation of the very fundamental principles of our Society. With these criticisms in mind allow me to put forward this reasoning: we are proud in proclaiming that we have in our membership the most capable and efficient tool engineers in the Detroit area, among whom are expert tool and die designers of proven ability. The manufacturers and their employment managers are fully aware of that fact. We have already been asked to recommend men for particular lines of tool work, and they were accepted for the positions. But let this not be misconstrued. The Society did not place these men in their positions. We only *co-operated* with the employer. Therefore, if we continue our educational program, raise the standards of tool engineering, and broaden the knowledge of our members, is it not good logic to expect that, when business warrants it, the employers will seek our assistance when prepared to man their designing and engineering posts most efficiently?

SOCIETY TO HAVE INDUSTRIAL RELATIONS COMMITTEE

With confidence in a speedy resumption in employment, our new President, William H. Smila, is considering appointments to an Industrial Relations Committee, whose duties will be to make a canvass of our unemployed members with the end in view of investigating their respective qualifications, and negotiating with the employment managers of the various manufacturers, thus helping the former find positions and the latter fill their employment requirements.

At this time I wish to express my sincere appreciation to the officers, directors, and members of the Society for the very friendly and energetic co-operation they so willingly gave during the past year in organizing and furthering the ideals of the Society. It afforded me great pleasure in working with them, and if space would permit I should like to elaborate in detail upon the great good accomplished by the hard work and long hours put in by many of them, particularly in the Secretary's office and in the Publicity Committee's work. Altogether, through this hard work and co-operation, we have not only succeeded in maintaining the high standards we set up when we organized, but have improved our Society and its activities to such a degree that reference to our records should be a great source of pride to us in years to come.

In conclusion, I wish to extend my best wishes to our new President, Mr. Smila, and his co-workers for their greatest success in making the future of the A. S. T. E. a history of great achievements.

Sincerely,

JOSEPH A. SIEGEL.

LAST MEETING

We are printing, below, an abstract of the paper read at the April meeting of the A.S.T.E. by Mr. B. H. WORK, of THE CARBORUNDUM COMPANY. In conjunction with the paper, a film, entitled "Jewels of Industry," was presented, which was of great interest to all present at the meeting. Mr. Work's paper follows:

MANUFACTURE AND APPLICATION OF ELECTRIC ABRASIVES

The use of abrasives probably dates from man's early experience in the use of tools. Prehistoric man shaped his various tools by rubbing them against rocks having abrasive qualities. Historical records show that as early as the 14th or 15th century blocks of stones were cut from natural deposits and used in the form of wheels. These first abrasive wheels were of sandstone, and it wa not until the middle of the 19th century that bonded abraive wheels were manufactured.

The abrasive materials used in the fabricating of these bonded abrasive products during this period were emery, corundum, and quartz. All of these forms of natural abrasives vary in actual percentage of abrasive materials they contain, and also in the percentages and type of impurities. The early history of bonded abrasive wheels manufactured from natural abrasives found the fabricators of those abrasive products working with basic abrasive materials which varied to such an extent that it was impossible to duplicate or control the products manufactured from these natural abrasives.

It was in the later part of the 19th century that the electric furnace abrasives were developed, and two types of controlled manufactured abrasive materials were made available. These two abrasives are aluminum oxide (Al_2O_3), and silicon carbide (SIC).

Field of Application of Electric Furnace Abrasives

These two electric furnace products find many applications in industry outside of the abrasive field, as well as a variety of applications within the abrasive field. A brief outline of the scope of application of manufactured abrasive products will give an idea of the diversification of their uses.

The classification of manufactured abrasive products in industry today may be roughly divided into six major products or lines in which the abrasive properties of the materials are of first consideration. There are four classifications in which the abrasive property is secondary to other physical properties.

The six major classifications are as follows:

1. Abrasive Wheels.
2. Coated Abrasives.
3. Polishing Grain.
4. Honing Tools.
5. Lapping Compounds.
6. Miscellaneous Abrasive Tools. (Such as sharpening Stones, Rub Bricks, etc.)

The classification of abrasive materials found in fields of application where physical properties other than the abrasive property are commercialized are:

1. Refractories.
2. Non-metallic Heating Elements.
3. Filter Plates.
4. Floor Tile or Mixtures of Abrasive Grains and various binding agents for floor and stair surfacing.

The first six classifications given may all be classified as "Abrasive Production Tools."

Uses and Purposes of Abrasive Production Tools

All of the six classes of abrasive tools enumerated have a great diversity of application, and that this may be clarified, we have classified these under six general functions.

1. Generation of Surfaces (Forming).
   This class may be further subdivided as follows:
   (a) Cylindrical—Straight, Tapered, Formed.
   (b) Flat—Plane, Moulded.
   (c) Holes—Straight, Tapered, Formed.
   (d) Miscellaneous Curved Surfaces, Gear Teeth, Cams, Balusters, or Columns such as are produced in the stone trade.
2. Removal of Stock (Snagging).

The purpose of these abrasive tools is simply to remove stock or metal. These operations are not concerned with the degree of precision or accuracy involved in the first application.

This third classification may or may not involve precision. This may involve the production of rough surfaces such as are produced by grinding wheels in the sueding of leather or the production of surfaces for optical effects on such materials as glass, steel sheets, etc.

4. Abrasive Parting Operations (Cut-Off Wheels).
5. Production of Sharp Edges or Points.

This 5th classification covers the diverse field of knife grinding and tool grinding.

6. Reduction of Material in particle size or form

This 6th classification involves the use of abrasive tools where grinding chips are the product sought. Illustrations of this are the reduction of such materials as pulpwood for the production of fibre for paper making and the grinding of flour.

These six fields of general application are rarely found in these simple forms. The modern production grinding problems are complex and the abrasive tool is expected to perform several of these functions, economically in one operation. Stock removal is always a requisite and when complicated with specifications calling for close tolerance and high finish, as is generally the case, a proper balance in abrasive action must be established to meet the specifications of the particular job, at the lowest obtainable cost. We need not point out that accuracy, rapid stock removal, and finish are incompatibilities, and necessitate a comprised specification in the abrasive tool which is expected, in a single operation, to perform all three functions at an economical cost.

Having presented in outline form the scope of application of electric furnace abrasives, and a brief generalized statement of the uses and functions to which these various products are put, further discussion will be limited to the manufacture and uses of abrasive wheels.

Conditions Surrounding Grinding Wheel Operation

Before proceeding with a discussion of wheel characteristics, let us review in a very general way the conditions under which abrasive wheels operate and the manner in which they perform their several production tasks.

Where does the grinding wheel differ from the cutting tool? It differs in that it must be self-sharpening. This statement is too broad to fit the condition found on all production jobs, but it is true on all grinding operations where heavy stock removals are to be made and a high degree of accuracy is not demanded.

On grinding operations where accuracy is a factor, the sharpening is left largely to a dressing tool, but in such cases a study of the actual facts will bring to light other conditions which will serve to differentiate the grinding wheel, which is performing satisfactorily, from the cutting tool.

A grinding wheel which is giving satisfactory grinding action must be operating in such a manner that immediately at the grinding face the stresses (set up by the wheel rotation and work pressures) are close to or at the ultimate strength of the bond and grain structure. A slight increase of pressure or working forces will break grain crystals or dislodge the grains while a slight decrease in pressure or working forces will permit dulling of crystals and glazing. In other words any reduction in stresses will cause the wheel to act "harder." Any increase in stresses will cause the wheel to act "softer."

One point which should be emphasized here is that the grinding wheel which will give the best grinding action cannot be subjected to variation in working forces without the sacrifice of either cutting action or of abrasive material.

An analysis of stresses developed in grinding operations will provide a basis to introduce the proper conception of the variables which affect wheel action.

1. The relation of wheel speed to work speed will determine the shearing force and in a measure the compressive force acting on the wheel face. A proper ratio or balance must be arrived at between wheel speed and work speed for economical wheel operation.

2. The rate of traverse or cross feed accounts for another shearing force acting on the wheel face and is also a factor in the compressive force exerted on the whole or a portion of the wheel face.

3. The area of contact between work and wheel face are factors affecting the compressive forces acting on the wheel face. (The area of contact between wheel and work differs materially in cylindrical, internal and surface grinding operations.)

4. The physical properties (principally ductility, hardness, and tensile strength) of the materials being ground are factors affecting the shearing force of the wheel face.

5. The physical properties of the material being ground together with the rate of infeed are factors affecting the compressive forces on wheel face. (Hard materials resist penetration of the abrasive grits or grains, hence the compressive force built up between work and wheel at the point of contact is greater on hard materials than on soft materials. Materials of high tensile strength build a greater shearing stress than those of lower tensile strength.)

6. In service the abrasive wheel is constantly diminishing in diameter, and of a consequence, the relation of wheel speed to work speed is constantly changing.

7. The reduction in diameter of the abrasive wheel also constantly causes a decrease in the arc of contact between wheel and work.

It is apparent from the foregoing analysis that the stress conditions under which an abrasive wheel performs its functions are complex, and that in no grinding action are these stresses constant, even neglecting all other operating variables such as physical characteristics of materials, machine conditions, and the operator's skill.

Manufacture of Abrasive Wheels

All abrasive wheels are composed of two base materials, abrasive material and bond material. Further variables lie in process methods. These three factors, abrasive, bond and process, create a still further variable wheel structure.

Abrasive Material in Wheel Manufacture

We have stated there are two distinct abrasive materials in common use in abrasive wheels. First—fused aluminum oxide (Al_2O_3). Second—carbide of silicon (SIC). These are manufactured by The Carborundum Company under the respective trade names of Aloxite and Carborundum, and under various well known trade names by other companies.

Properties Required in an Abrasive

An abrasive, to be of any use for grinding, must have the qualities of hardness, toughness, fracture, and crystal size. The electrically fused alumina has a hardness of 9.2-9.6 Moh. Silicon carbide has a hardness of 9.5-9.75 Moh. The fused aluminum oxide is tougher than silicon carbide, that is, it shows greater strength under strain. The fracture of the abrasive has to do with the condition of the surface left after breaking off of particles. Because silicon carbide is harder and less tough and has a different fracture than electrically fused alumina, it is more efficient in grinding materials of low tensile strength, whereas the tougher fused aluminum oxide is best suited to grinding materials of high tensile strength.

Preparation of Abrasive for Bonding

To place these electric furnace abrasives in a form useful in the manufacture of abrasive wheels, they are processed by crushing and grinding, chemical treatments, sifting, and various other processes which are unique with the abrasive manufacturers. All of these processes are subject to laboratory control.

Let us consider for a moment the variables which the wheel manufacturer is called upon to control in the production of a uniform marketable product and the factors which can be utilized in influencing grinding action in this product.

Each abrasive grit or grain of aluminous abrasive (the term "grit" or "grain" being used here is descriptive of abrasive material graded to standard marketable sizes) is composed of a number of individual crystals held together by a matrix of non-abrasive materials. The matrix can be varied to product a binder of greater or lesser strength which will govern the toughness of each individual grit or grain.

In the production of abrasive materials, additions to the furnace mix and proper adjustment of fusing temperatures, cooling rates, etc., will produce varying lines of fracture. (The above statements apply particularly to Al_2O_3).

In addition to these properties, controlled chiefly in the furnace practice or manipulation, there are other points of control necessary in the crushing and grinding which have a definite bearing on the action of the fabricated wheel.

(a) Grit Shape.

(b) Grit Size (Uniformity).

Grit or shape has a definite bearing on the ultimate action of the abrasive either in the form of polishing grain or wheels.

Uniformity of size and shape of grit must be controlled in the production of uniform wheel structures.

Bonds

The bond or bonding material is the second element involved in the manufacture of abrasive wheels. Five distinct types of bonding materials are used in the fabrication of abrasive wheels:

Clays or Glasses (Vitrified).

Rubber (Vulcanite).

Shellac (Elastic).

Redmanol or Bakelite (Synthetic Resin).

Silicate (Sodium Silicate).

Each of these bonding materials imparts definite characteristics to the abrasive wheel in which it is used, and each has a rather definite field of application although these fields overlap in many instances. Further, variation in processes can be used in fabricating wheels with any one of these bonds.

Wheel Structure Grade

An examination of the terms "structure" and "grade" is necessary before proceeding. Our conception of "structure" is the relationship of grain to bond in space; "grade" is the sum total of grain, bond and structural effects in offering resistance to grinding stresses. Structure and grade effects according to this conception start with the individual abrasive grains.

Grinding wheels perform their several tasks while gradual disintegration is taking place. The lower the rate of this disintegration in proportion to the work accomplished, the higher the efficiency of the grinding wheel structure.

An analysis of the stresses and the reaction of the structure and grade effects to these stresses will clear up many misconceptions in regard to wheel action.

As stated before, a specific grit or grain is composed of a number of individual crystals held together by a matrix of non-abrasive materials. This grain structure is the first point of resistance where the breaking action can occur. If you chose you could speak of "crystal grades" and "crystal structures."

The next point at which the grinding stresses can affect disintegration of the wheel body proper depends on the tenacity with which the grain is held by the bond and the type of setting or bond distribution around this grain.

A balance must be established between grain strength and the "grain to bond union," which will allow the gradual breaking down of the grain to be followed by the unseating of the grain from its bond setting as soon as the crystal has dulled. In fitting a wheel to a specific grinding operation the type of operation, machine equipment, method of performing this grinding operation and the material to be ground largely determine the composite "grain-bond-structural-grade" effect necessary to give economical wheel performance.

In connection with any discussion of the action of porosity, or the spaces between grains, we should consider two grinding wheel phenomena which are commonly identified by the terms "loading" and "glazing." The term "loading" refers to the embedding of the material being ground on the grinding face of the abrasive tool performing the grinding operation.

The solution of many grinding wheel difficulties hinges on the proper analysis of the condition of this load on the wheel face. The pores, or voids, in the abrasive structures of the wheel provide the clearance for the removal of chips from the sphere of grinding operations. Loading may be of several different types.

In general, the further the grinding chip is carried through the actual zone of wheel and work contact after being freed from the parent body, the greater the danger of loading occurring.

Changing of the grit sizes and the form and shape of the pore space, or the introduction of certain fillers into the wheel, or coolants on the work face may be used to correct loading conditions.

Spaces or voids play an important part in the release of grinding chips, and grinding chips can be the cause of various stresses that have not been given consideration in our previous analysis.

The term "glazing" can only be properly applied to cases where the resistance to stress at the point of "grain-bond-union" holds the grain so firmly (or the grain is so weak in matrix) that it breaks down at its bond setting and gradually allows the work to wheel contact to ride not on cutting points but on the broken area of crystals which assume a polish and on the non-abrading bond medium.

In all practical wheel applications slight glazing and loading tendencies show if the wheel structure and grade is correct. If the wheel face shows entire freedom from these tendencies a too rapid a breaking action is shown for those jobs where close tolerances are to be held and finish will be affected. In cases where the job requirements cover only the function of stock removal the abrasive cost will be abnormally high.

The ideal wheel on most operations maintains slightly glazed or loaded areas, uniformly distributed over the entire face, and must be operated under stresses which will keep the balance of cutting area in constant ratio with the loaded and glazed areas.

We have pointed out the necessity for uniformity of stress if uniform grinding action is to be obtained. As a correlary of this, uniform "structure" and "grade" must be maintained throughout the entire grinding body if uniform grinding action is to be maintained. *Homogeneity* is a necessity as is *inherent balance*, for lack of these qualities are contributary causes of chatter and numerous other objectionable phenomena. An ideal piece of grinding equipment can be thrown into vibration by a lack of either of these basic wheel requirements, just as the operation of a wheel possessing these requirements may be ruined by poor machine or operating condition.

From the above facts it is not hard to arrive at the conclusion that there are many ways to build grinding wheels which will give satisfactory grinding action. Further, that the good grinding wheel is not a product of any one single step in a process, but rather is evolved from a long series of carefully supervised, technically controlled operations. Careful inspection must be maintained in each step of the process and a final speed test must be applied to insure safe operations.

If a "Grinding Art" still exists it is not to be found in the field of wheel manufacture, but rather exists in those fields beyond manufacture, in the fields of recommendation, application and operation.

The proper application of a wheel requires a careful analysis of (1) nature of material to be ground, (2) type of grinding operation, (3) methods and conditions surrounding the operation plus a knowledge of wheel characteristics and grinding action.

This work requires the highest type of co-operative effort between the user and the manufacturer of abrasive tools.

Travel Note.—"Does the giraffe get a sore throat if he gets wet feet?"

"Yes, but not until the next week."—

Life's Little Surprizes.—What a world! To be a valedictorian and then get a job working for a fellow who dropt out at the eighth grade.

He Holds the Queen.—"What I am today I owe to my wife," he said proudly.

"Well, what are you?" the other sneered.

"I'm the husband of the best bridge player in our neighborhood."

Scrambled Fiction.—They say Shakespeare never told the same story twice, but there's nothing unusual in that. Plenty of court witnesses have the same record.

Down Where the Wurzburger Flows.—The policeman's son was learning music.

"How many beats are there to the bar in this piece of music, Dad?"

"Fancy asking a policeman a question like that," said the boy's mother. "If you asked your daddy how many bars there were to the beat he might have been able to tell you!"

NEW DEVELOPMENTS IN TOOLS

Announcement is made of the formation of a new company known as SWARTZ TOOL PRODUCTS CO., Inc., 5259 Western Ave., Detroit, Mich.

The personnel of organization as follows:

G. E. Swartz, President.

E. W. La Monte, Vice Pres. in charge of manufacturing.

C. G. Dahlquist, engineering and sales.

C. A. Sweeney, engineering and tool design.

A completely equipped plant is available for more efficient and economical manufacturing of the well known line of Swartz standard fixtures and fixture locks, as well as providing, in addition, a source of supply for all manner of general tool designing and manufacturing, with capacity for 15 tool designers and 45 tool makers.

Plans have been made to provide a reduction in overhead and general expenses which are in keeping with the times, as well as increase the standard of engineering and manufacturing service to a greater degree than heretofore possible.

A new catalog No. 632 is available, displaying five different lines of fixtures containing many new features and designed to supply proper rigidity and long life as necessary for present day manufacturing requirements.

All fixtures have hardened and ground posts, with proper facilities for long hard service and liberal flanges, arranged to maintain correct alignment to fixture head relative to base.

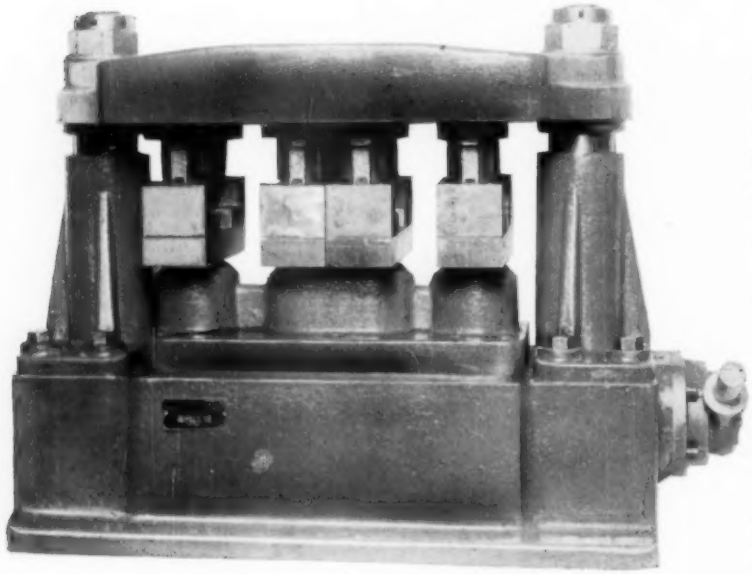


Fig. 1. Standard type compensating adaptor.

By the use of a standard type compensating adaptor as shown in Fig. 1, a number of parts can be chucked in one fixture at the same time and by the movement of one lever only.

Fixture clamping locks are supplied in five sizes and provide a most convenient, efficient, compact, and durable means for holding the clamping power in all manner of tool, jig and fixture operation. A plain or flat surface is the only requirement for mounting.

The inside structure consists of three driving keys and six locking rolls which provides fifteen locking contact points, insures a wide margin of safety for extreme loads, greatly relieves undue pressure at any one contact point and insures continuous service under most exacting conditions.

Fig. 2. Standard LH-type fixture.

The construction of the lock is such that a weighted lever as shown in Fig. 2, can be used for momentum clamping and still be free from any tendency toward destroying the efficiency of any parts, even under the most severe production requirements.

An important feature in the design of the lock is, that without the change of any parts other than assembly, it is possible to secure right hand, left hand, or both right and left hand operation.

NOTICE

Due to an oversight on the part of the advertising division, two advertisements of counterbores, one the Eclipse "Micro-Justable" holder and the other one the Wesson Counterbore, were placed side by side on the inside cover of the March issue of this Journal. Lest any of our readers may have interpreted a connection between the two companies, we wish to inform them that the Eclipse Counterbore line is sold only through its own direct representatives.

TOOL AND DIE DESIGNERS: Now that you have the time available and probably not an over-abundance of $$$$ due to the bank holidays, you will be glad to know that the Detroit College of Applied Science has a group educational plan which makes it possible for you to use your spare time to learn more about any phase of mathematics (through Calculus), Mechanics, Strength of Materials, or other engineering phases of your profession, either in day or evening classes, at a cost which is cheaper than doing nothing. Call Madison 5048 between 10 A.M. and 5 P.M., or 7:30 and 9 P.M. any day except Saturday. Call between 10 A.M. and 1 P.M. Saturday.

SITUATION WANTED—STENOGRAPHER, female, 14 years engineering and general business experience. Thoroughly familiar with technical terminology and routine. Highest references furnished. Very moderate salary. Write or phone care of A.S.T.E. Secretary, 8316 Woodward Avenue, Madison 2057.

Loose Shutter, Maybe.—Elderly Aunt (to her nephew, a poor preacher)—"James, why did you enter the ministry?"

"Because I was called," he answered.

"James," said the old lady anxiously, as she looked up from wiping her spectacles, "are you sure it wasn't some other noise you heard?"

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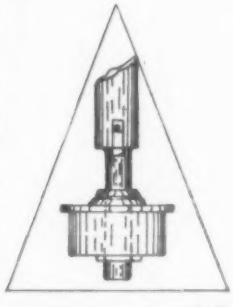

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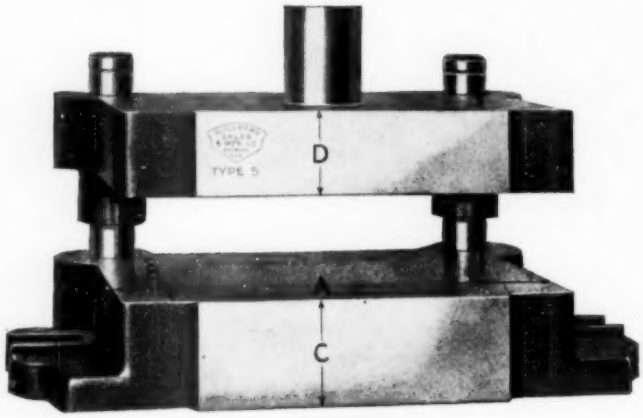

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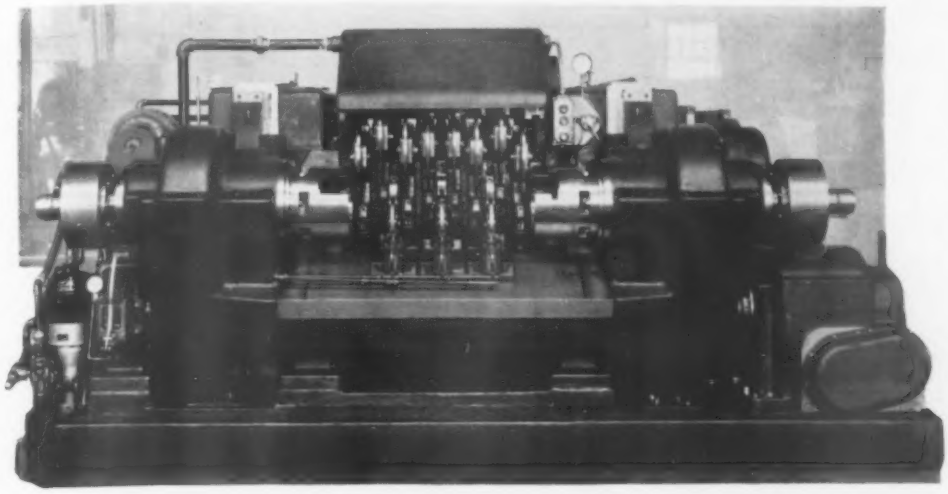

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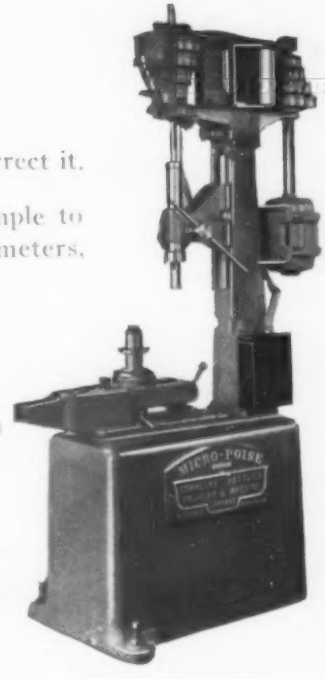

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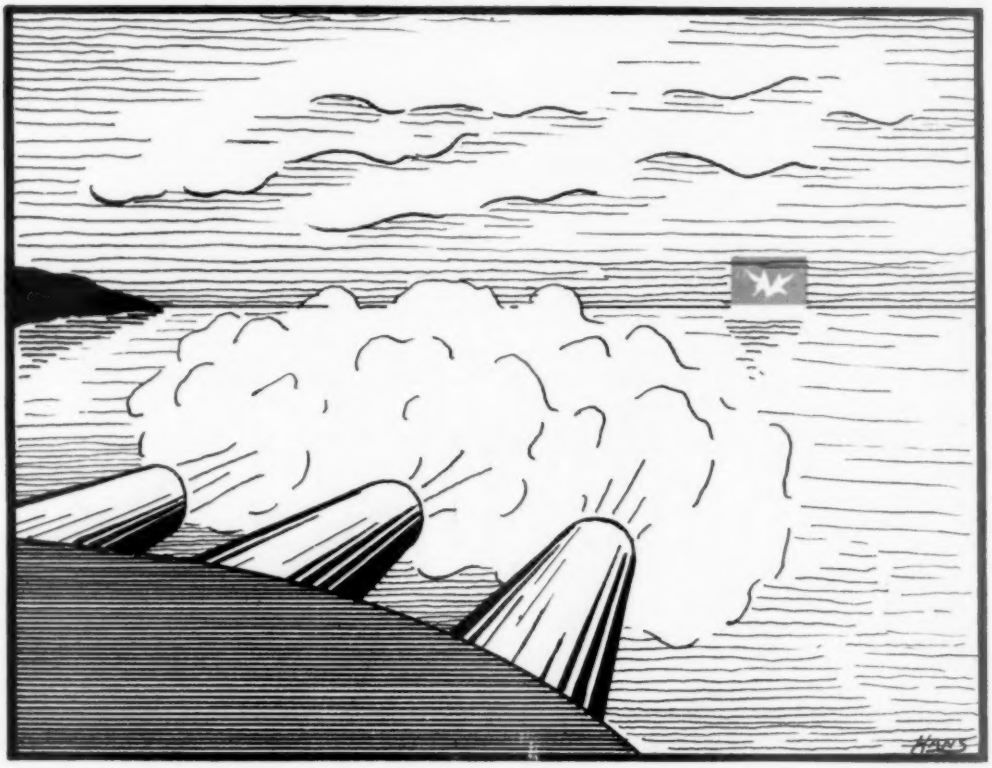

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